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(54) Hard dental reconstruction material for anchoring in canals

In order to give hard dental reconstruction materials anchored in the root canal a naturally translucent appearance, to simplify their incorporation into the root, and to weaken the root as little as possible in the process, enlargeable intracanal hard dental reconstruction materials are made of fiber-reinforced plastic - instead of entirely or largely of metal, as in the past.

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## Patent claims

1. Hard dental reconstruction materials for anchoring in canals, characterized by the fact that it consists entirely or partially of fiber-reinforced plastic.
2. Hard dental reconstruction materials for anchoring in canals in accordance with Claim 1, characterized by the fact that the reinforcement is provided by unaligned short fibers.
3. Hard dental reconstruction materials for anchoring in canals in accordance with Claim 1, characterized by the fact that the reinforcement is provided by straightened fibers.
4. Hard dental reconstruction materials for anchoring in canals in accordance with Claim 3, characterized by the fact that the reinforcement is provided by a number of differently oriented fibers.
5. Hard dental reconstruction materials for anchoring in canals in accordance with Claim 1, characterized by the fact that the reinforcement is provided by translucent fibers.
6. Hard dental reconstruction materials for anchoring in canals in accordance with Claim 5, characterized by the fact that the reinforcement is provided by light-conductive fibers.
7. Hard dental reconstruction materials for anchoring in canals in accordance with Claim 5, characterized by the fact that the reinforcement is provided by glass fibers.
8. Hard dental reconstruction materials for anchoring in canals in accordance with Claim 1, characterized by the fact that the reinforcement is provided by carbon fibers.

## Description

## Category of the subject of the application

The invention pertains to a hard dental reconstruction material, to be anchored in the canals.

## Tasks relating to the category

Teeth with complete or substantial loss of the natural coronary crown material can often be rebuilt using artificial material, which is anchored in the prepared and apically filled root canal. One usually starts by building up a stump, and then builds an artificial crown upon that.

## State of technology, with sources

1. Reconstructions of missing teeth which are anchored in the root canal are made today of metal for reasons of mechanical strength and rigidity. Plastics or ceramics are sometimes employed in addition only for the peripheral crown area.

The built-up restorations are either made in a dental laboratory after preparation of the root and any remaining crown material and an impression, and then cemented in place by the dentist in a second treatment ("cast pinned restoration") (1), or they consist of an anchoring screw with self-cutting thread which is screwed into the appropriately prepared root canal, with retaining fixtures on the head of the screw for attaching plastic filling material, which the dentist uses to replace the missing substance. (2)

For placing translucent crowns it is recommended that the dark metal core be coated in a color similar to the material of the tooth; for instance, with a bake-on ceramic coating in the case of the cast pin restoration. (3)

Plastics can be manufactured with color and translucency similar to teeth, but are too weak mechanically to be used for the fabrication of built-up restorations for intracanal anchoring.

2. There are easy-to-handle adhesive systems on the specialty market for cementing plastic filling to the dentine (4), but not for cementing metals to the dentine. Attaching the metal anchors therefore requires the

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dentist to first prepare retention points in order to achieve the connection of metal to tooth substance by means of interlocking and friction.(1)

3. The strength and rigidity of plastics can be increased significantly by incorporating high-strength fibers with a high modulus of elasticity. The best results are obtained through the use of bundled fibers. In this case the strength and the modulus of elasticity are increased in the direction of the fibers.(5)

Fiber-reinforced plastics have also already been used successfully in dental therapy.(6)

#### Criticism of the present state of technology

Even with translucent crowns, the translucency of a healthy natural tooth can only be imitated optimally if the tooth stump beneath it has a natural translucency. It must not contain any opaque areas—such as areas of metal—and hence no restorations with traditional intracanal anchoring.

Additional disadvantages of these traditional restorations are:  
Complicated fabrication of the cast pin restoration in the dental technician's laboratory and the need for two treatment sessions with the dentist,  
sometimes insufficient strength of the screw restoration, and the inability to use it if the root canal has a larger diameter than the core of the screw thread.

Furthermore, the wall of the dead root, which is often soft already and weakened by the preparation, is weakened further by the cutting effect of the thread.

#### The problem

The following requirements are placed on the intracanal-anchored dental restoration:

1. Adequate mechanical strength and rigidity,
2. biological tolerance,
3. dentine-like color and translucency,
4. minimum possible weakening of the root canal wall.

#### The solution

The problem is solved by means of a restoration of the appropriate category with the characterizing features of Claims 1 and 5, if one uses a proven biologically compatible material which is similar to the teeth in color and translucency, reinforced with fibers of proven biological tolerance which are colorless or similar in brightness to the teeth, such as glass. If one is willing to forego requirement 3, then a substance such as carbon fibers can also be used.

#### Additional refinement of the invention

The fabrication of a restoration of appropriate category in accordance with Claim 2 is relatively simple technically. The fabrication turns out to be more complex according to requirement 3, let alone 4, but at the same time greater strength and rigidity may be expected.

The design of an appropriate restoration according to Claims 3 and 6 offers the possibility of intentionally guiding light through the restoration, for example from the crown into the root.

#### Attainable benefits

By varying material, length, diameter, orientation, proportional volume, and perhaps coating to promote adhesion, and by varying the plastic matrix, it is possible to vary strength, rigidity (both may be dependent upon orientation), as well as color and translucency, within a very broad range.

With compatible plastics and the appropriate adhesive system, restorations which conform to this patent application can be attached to the dentine of the canal wall and the floor of the cavity without any need to first have an exact fit. The requirements for preparing the root canal and cavity are therefore less demanding than for traditional restorations.

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The plastic which is used for attachment when the restoration is installed can also be used to complete the restoration. If the fibers are light-conducting, and if they are bundled in the longitudinal direction of the canal, then light-hardening adhesive plastic can also be considered, since light which strikes the crown is conducted down to the deepest areas of the canal.

The clinical reconstruction of missing dental material using a built-up restoration of fiber-reinforced plastic with intracanal anchoring is therefore technically relatively easy to accomplish.

In contrast to the threaded restoration technique, the canal wall is not weakened by threads.

In particular, the reconstruction according to this application furnishes the ideal intracanal anchored tooth substance reconstruction, where the translucence of natural teeth is to be imitated through the use of translucent crowns.

#### Description of two sample executions

Fig. 1 shows a restoration of this sort according to Claim 1, in situ, in longitudinal section.

Fig. 2 shows a restoration of this sort according to Claim 4.

The central bundle of fibers lies in the direction of the root pin, so as to protect it from bending loads.

Directly under the outer surface of the crown reconstruction 4 in the shape of a conical stump, are 2 courses of fibers oriented diagonally to the axis of the root pin with the same angle between the axis of the pin and the direction of the fibers but with the opposite orientation. The purpose of this arrangement of the fibers is to make the reconstruction resistant to twisting around the axis of the pin.

#### Legend for the illustrations

- 1 Root with remnants of crown material
- 2 Root filling
- 3 Root pin
- 4 Crown restoration
- 3+4 Hard dental reconstruction material with intracanal anchoring
- 5 Attaching plastic
- 6 Supplement to the restoration
- 7 Reinforcing fibers

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[On page with drawings:]

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#### Drawings

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**TCR***The Translating Company***CERTIFICATE OF ACCURACY**

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Gertrud Mathys being duly sworn, deposes and says that she is the President of Translation Company of America, 10 West 37th Street, New York, NY 10018 and that she is thoroughly familiar with ALAN GALT who translated the attached document relating to:

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*Gertrud Mathys*

Sworn before me this  
7TH day of MARCH, 1997

*Richard J. Mazzotti*  
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